

PACIFIC NORTHWEST SEISMOGRAPH NETWORK OPERATIONS

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Non-technical Summary

The Pacific Northwest Seismograph Network ([PNSN](http://www.pnsn.org)) operates seismograph stations in Washington and Oregon, and collects, analyzes, and distributes earthquake data and information. Between Oct. 1, 2004 and Sept. 30, 2005 the PNSN analyzed 10,370 events. Of these, 8,284 were earthquakes or blasts within the network (988 of which were too small to locate). Within the network area, 7,691 earthquakes were located west of 120.5 degrees west longitude (including 6,500 at Mount St. Helens, which began a magmatic eruption earthquake sequence on Sept. 23, 2004, just a few days before the beginning of this reporting period), and 252 east of 120.5 degrees west longitude. The remaining events were blasts within the network (407), regional earthquakes (412), teleseisms (667), low-frequency events (587 events, 48 locatable, including ice-quakes near the summit of Mt. Rainier, and a few events associated with the eruption of Mount St. Helens), and surficial events (39 events, 11 locatable, mostly rockfalls near the summits of Mt. St. Helens and Mt. Rainier).

West of the Cascades, 6 earthquakes were reported felt in Washington or Oregon, ranging in magnitude from 2.6 to 3.5. The largest events, both magnitude 3.5, located about 12 km southeast of Granite Falls (on March 6 UTC, depth about 14 km) and 10 km northwest of Yakima (on June 29 UTC, depth about 10 km).

East of the Cascades, two earthquakes (magnitudes 3.1 and 3.5) were reported felt. Both were in southern Oregon, located at about 12 km depth approximately 15 km south-southeast of Lakeview.

This year, one episode of "Episodic Tremor and Slip" (ETS) was observed. ETS is composed of low-amplitude deep seismic tremor observed concurrently with very slow geodetic movement. ETS episodes occur periodically at 13 to 16 month intervals and are interpreted as slip on the Cascadia Subduction Zone fault. The "[deep tremor](#)" signals originate at depths between 20 and 60 km. Silent slip and tremor occur simultaneously in approximately the same place and appear to be closely related, though the exact mechanisms are still being debated.

Network Operations

The Pacific Northwest Seismograph Network ([PNSN](#)) operates 191 short-period, broad-band, or strong-motion seismic stations west of 120 degrees west longitude under this agreement, and 39 additional stations under other support. Some stations include up to 7 components. PNSN stations in southern and central Oregon are maintained by the University of Oregon under Cooperative Agreement [04HQAG006](#). The PNSN exchanges real-time data with adjacent networks to improve our ability to locate earthquakes on the edge of our network. The PNSN records and assists with the maintenance of several short-period stations operated by the USGS, and receives real-time data from seven US National Network (USNSN) and six Earthscope (USArray or PBO) stations in Washington and Oregon.

A PNSN seismologist is always available on-call, and our standard procedure is to respond to pager messages from our automatic earthquake detection process (initiated for any earthquake within our network of magnitude 2.9 or larger), or calls from Washington or Oregon emergency management agencies or the UW police. Information for well-located earthquakes is sent out automatically by the event detection process to select recipients including the national ANSS catalog. Emergency managers and other high-priority information users receive very rapid notification through the RACE pager-PC system, faxes, e-mail, and the national QDDS earthquake message system. Simultaneously, an automatic Web-site is created for the event (see http://www.pnsn.org/SEIS/EQ_Special/lasteq.html). ShakeMaps are generated automatically for events of magnitude 3.0 or greater in the greater Puget Sound and Portland areas and magnitude 4.0 or greater elsewhere in the region.

Final details are provided as soon as the duty seismologist analyzes the earthquake information. Final locations and magnitudes for earthquakes of $M \geq 2.9$ are also disseminated through the NOAA emergency weather notification system.

For all earthquakes, updates of information are posted to Web-pages each time the analyst finalizes a group of locations and magnitudes. In addition to ordinary phone lines, the PNSN has a radio link to the King County and City of Seattle Emergency Operations Centers and an independent direct phone link to the Washington State Dept. of Emergency Services.

The PNSN provides "Recent Earthquakes" web pages using the national "Quake Data Delivery System", "ShakeMap" pages (showing instrumental intensity, PGA, and PGV), and links to the USGS CIIM (Community Internet Intensity Maps) site, which collects, compiles, and interprets web-based felt reports from the public.

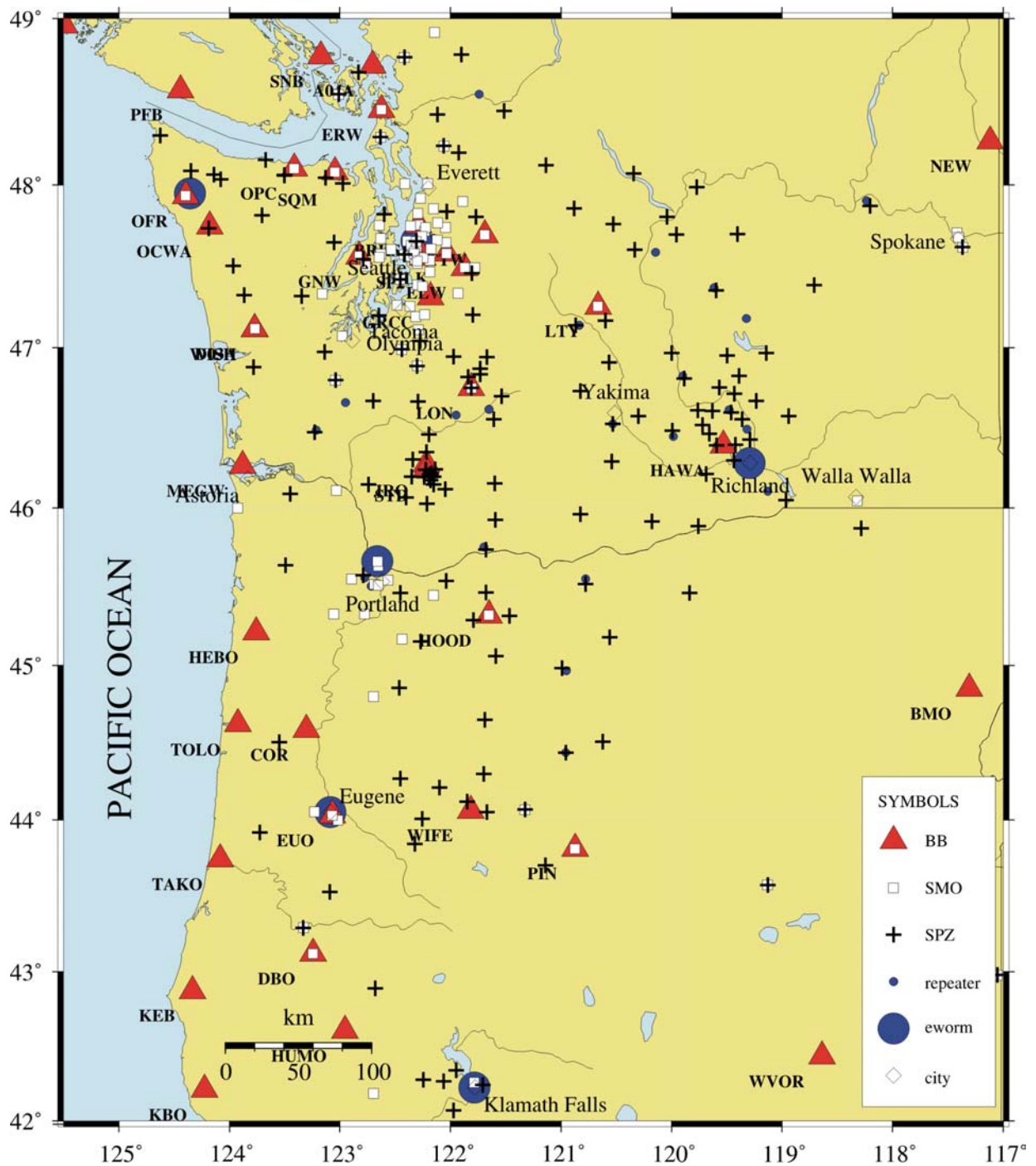


Figure 1a. Seismograph stations operated by or recorded at the PNSN at the end of September 2005. Black crosses indicate the locations of short-period seismometers, Red triangles represent the locations of three-component broad-band seismometer installations, and white squares show the locations of strong-motion stations.

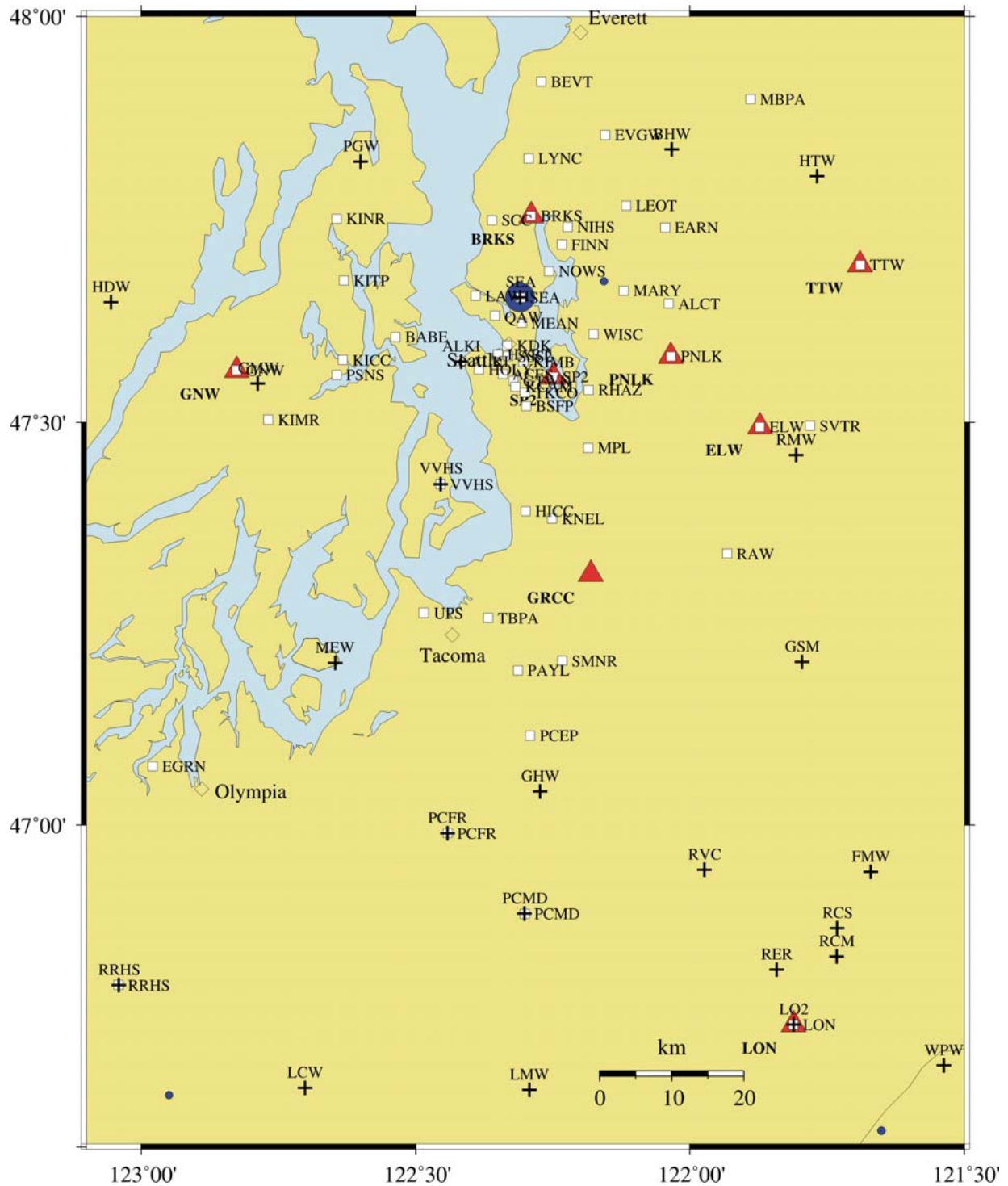


Figure 1b. Detail of Fig. 1a. Puget Sound Seismograph stations operated by or recorded at the PNSN at the end of September 2005. Symbols as in Fig. 1a.

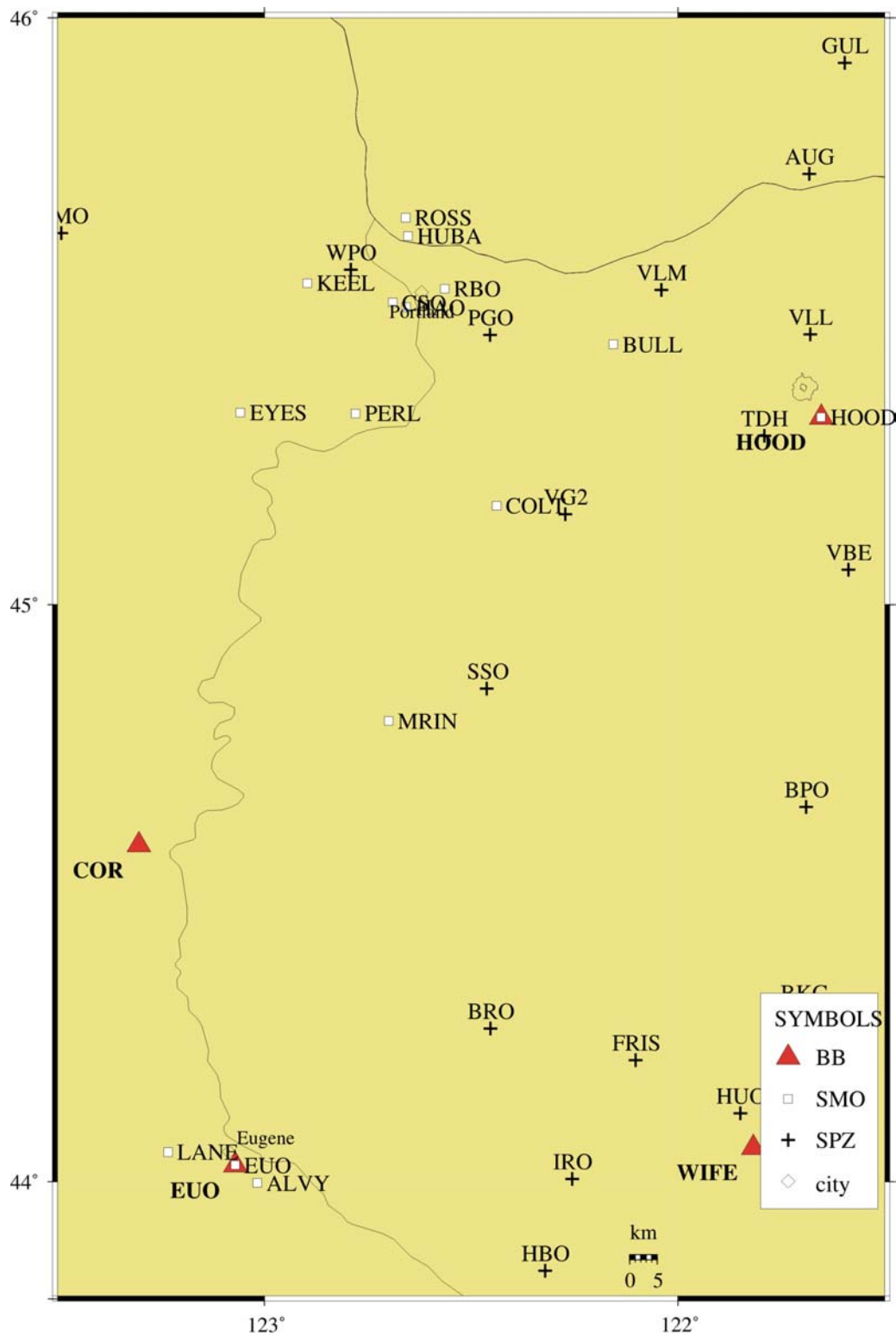


Figure 1c. Detail of Fig. 1a. Willamette Valley Seismograph stations operated by or recorded at the PNSN at the end of September 2005. Symbols as in Fig. 1a.

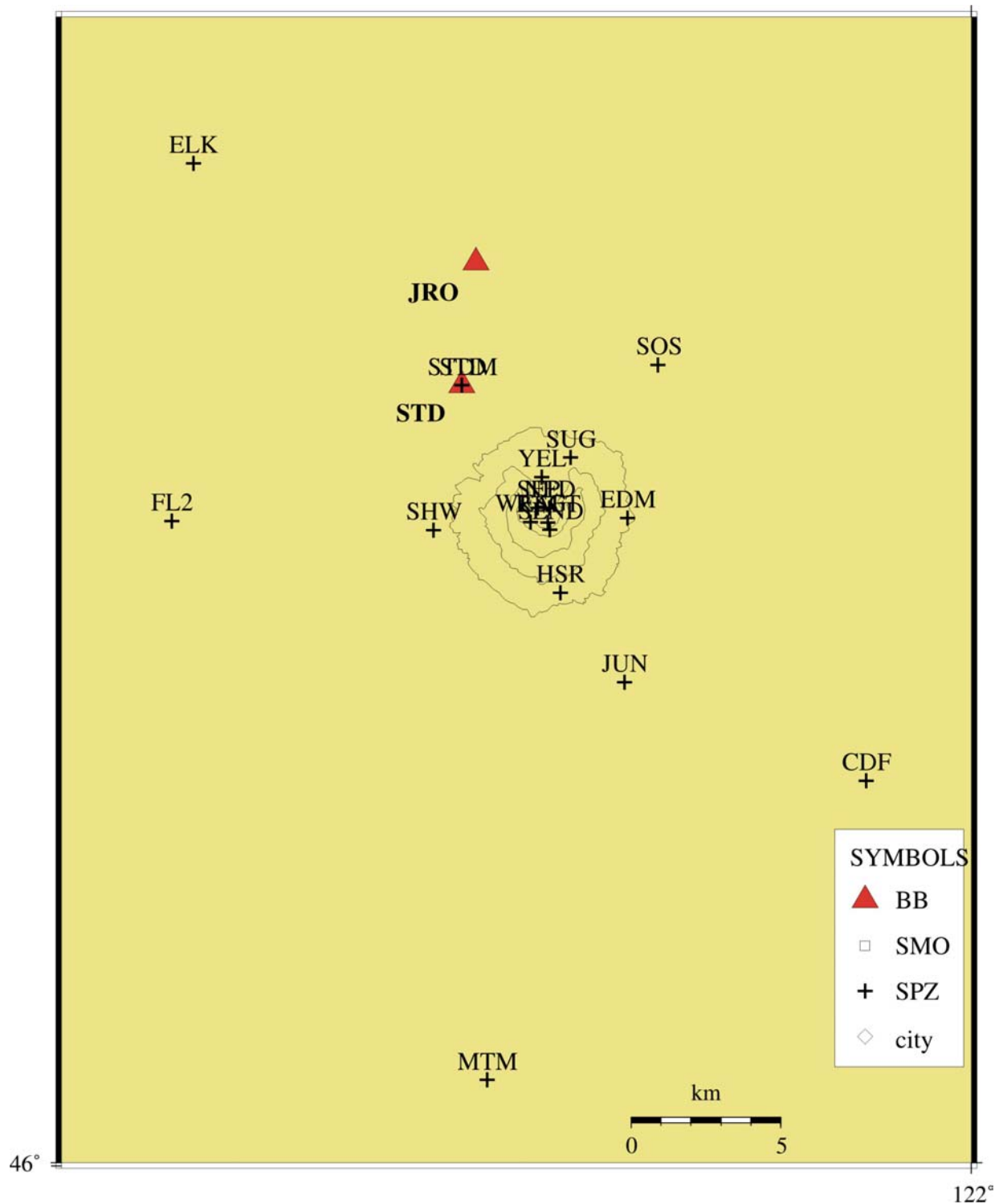


Figure 1d. Detail of Fig. 1a. Mount St. Helens Seismograph stations operated by or recorded at the PNSN at the end of September 2005. Symbols as in Fig. 1a. Contours shown are at 5,000, 6,400, and 7,500 feet.

- ***The PNSN Strong Motion and CREST Programs:*** Since 1996, the PNSN has installed digital strong-motion instruments, mostly in the Puget Sound urban area. There are now 53 ANSS instruments, and a total of 41 other strong-motion real-time stations operated under this agreement. Six additional strong motion stations are operated by other organizations, bringing the total of strong motion stations from which we receive or retrieve data to 100. Continuous data from 95% of these stations are sent to the PNSN via Internet or lease-line modem, but the instruments also have a trigger set to record stronger events on-site. If continuous data transmission fails, the data will still be available via dial-up retrieval or site visit.

The PNSN also operates 19 CREST (Consolidated Reporting of EarthquakeS and Tsunamis) stations, and records four additional stations operated by the northern California network.

- ***Data Availability:*** Continuous telemetry data streams from all PNSN broadband stations and the higher-quality short-period stations are recorded at the UW, and all broad-band and short-period data are provided to IRIS in near real-time via the IRIS BUD system. Complete unedited trace-data are saved for all network triggers. Edited, quality-controlled event trace-data are archived at the UW on large disks, 5 GByte exabyte tape, and on high-speed, high-capacity (15 GByte) digital linear tape (DLT) cartridges. Edited event trace-data are also archived at the IRIS Data Management Center (DMC) in SEED format, where they can be retrieved by any investigator via the standard IRIS data request mechanisms.

- ***Education and Outreach:*** Staff from the PNSN provide an educational outreach program to better inform the public, policy makers, and emergency managers about seismicity and natural hazards. Most of the PNSN strong-motion instruments are located at public schools. We provide information sheets, lab tours, workshops, and media interviews, and have an audio library with several tapes. Current seismic activity and other information are available via Internet on the World-Wide-Web (WWW): <http://www.pnsn.org>

- ***Special Events:*** PNSN staff participated in meetings with numerous groups, including hosting meetings of the **ANSS PNW Region Advisory Committee** (see www.pnsn.org/SEIS/ANSS/welcome.html), Cascadia Regional Earthquake Workgroup (CREW), and Contingency Planners and Recovery Manager (CPARM). and making presentations in other meetings, such as **ANSS, IRIS and Earthscope committees**, as well as numerous presentations for the general public. PNSN faculty, staff, and students authored a number of abstracts and articles.

Between Oct. 1, 2004 and Sept. 30, 2005 6 earthquakes were reported felt in Washington or northern Oregon west of the Cascades, ranging in magnitude from 2.6 to 3.5. Two earthquakes (magnitudes 3.1 and 3.5) were reported felt east of the Cascades. Two additional earthquakes, USGS magnitudes 6.4 and 7.2, occurred off the coast of Northern California and were reported felt by residents of Oregon. Details on dates, magnitudes, locations of felt earthquakes and whether ShakeMaps or CIIM maps were generated are in Table 1.

Between Oct. 1, 2004 and Sept. 30, 2005 the PNSN analyzed 10,370 events. Of these, 8,284 were earthquakes or blasts within the network (988 of which were too small to locate). Within

the network area, 7,691 earthquakes were located west of 120.5 degrees west longitude (including 6,500 at Mount St. Helens, which began a magmatic eruption earthquake sequence on Sept. 23, 2004, just a few days before the beginning of this reporting period), and 252 east of 120.5 degrees west longitude. The remaining events were blasts within the network (407), regional earthquakes (412), teleseisms (667), low-frequency events (587 events, 48 locatable, including ice-quakes near the summit of Mt. Rainier, and a few events associated with the eruption of Mount St. Helens), and surficial events (39 events, 11 locatable, mostly rockfalls near the summits of Mt. St. Helens and Mt Rainier). Fig. 2 shows earthquakes magnitude 2.0 or larger located during this reporting period.

TABLE 1-- FELT EARTHQUAKES Oct. 1, 2004 - Sept. 30, 2005

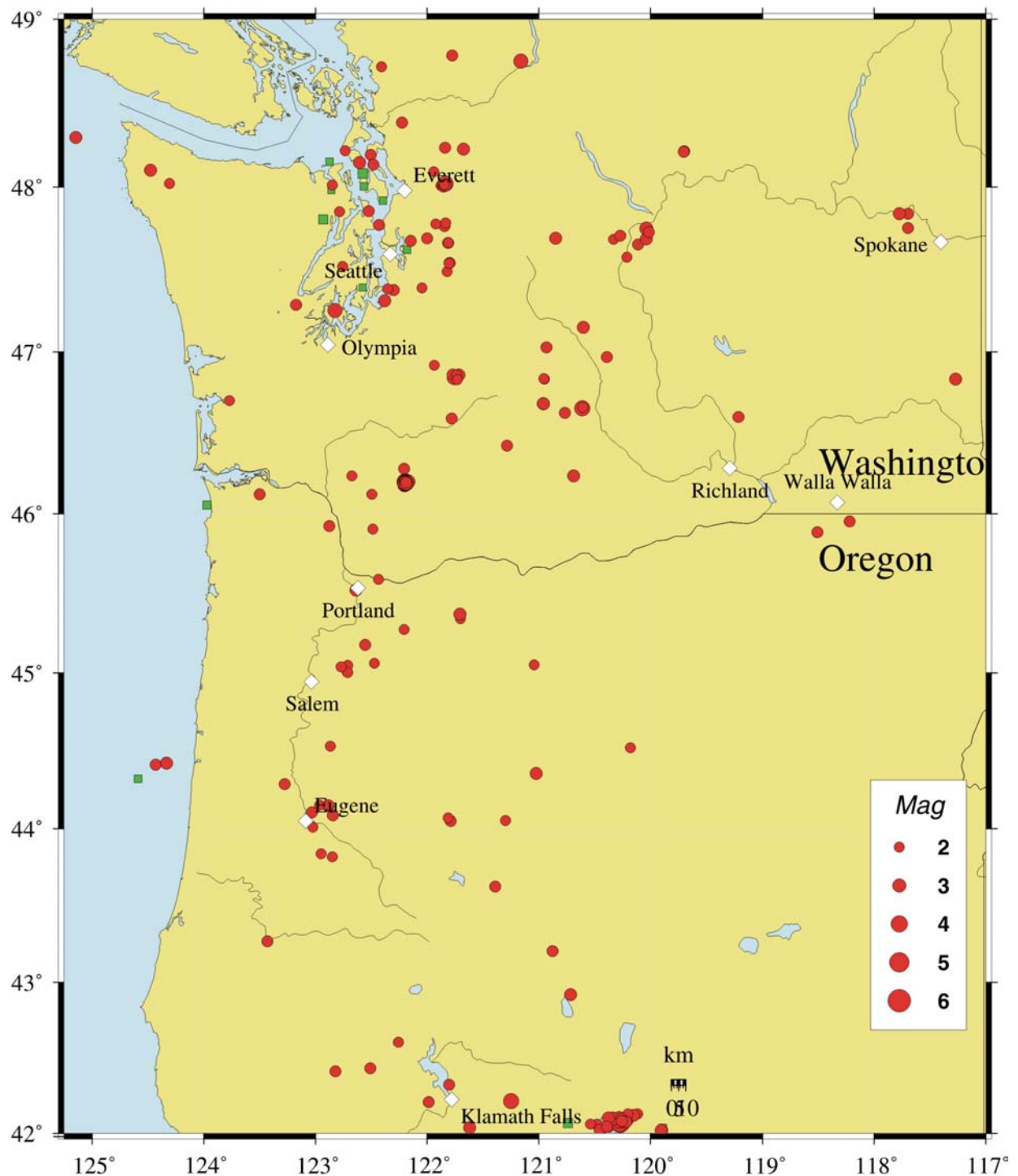
DATE-TIME is in Universal Time (UTC) which is PST + 8 hours.

Magnitudes are reported as local magnitude (MI).

QUAL is location quality A-good, D-poor

TABLE 1 - Felt Earthquakes Oct. 1, 2004 - Sept. 30, 2005

DATE-(UTC)- TIME	LAT(N)	LON(W)	DEP	MAG	COMMENTS	CHIM	Shake Map
yy/mm/dd hh:mm:ss	deg.	deg.	km				
04/10/30 06:47:03	42.06	120.29	12.2	3.1	15.0 km SSE of Lakeview, OR	✓	
04/11/16 18:21:28	42.06	120.27	12.0	3.5	15.5 km SSE of Lakeview, OR	✓	
05/02/03 14:08:04	48.08	122.57	32.2	3.1	30.4 km WNW of Everett, WA	✓	✓
05/03/06 13:20:06	48.02	121.83	13.6	3.5	12.2 km SE of Granite Falls, WA	✓	✓
05/03/13 03:37:47	47.25	122.82	24.1	3.3	23.8 km NNE of Olympia, WA	✓	✓
05/05/18 14:46:23	48.14	122.60	27.2	2.6	35.4 km WNW of Everett, WA	✓	
05/06/15 02:50:57	41.32	126.03	10.0	7.2 (USGS)	160.6 km WSW of Crescent City, CA	✓	
05/06/17 06:21:34	40.18	127.54	10.0	6.4 (USGS)	295.0 km WSW of Eureka, CA	✓	
05/06/25 13:49:11	45.52	122.63	14.9	2.7	2.0 km SW of Portland, OR	✓	✓
05/06/29 14:37:14	46.65	120.61	10.0	3.5	10.1 km NW of Yakima, WA		



- Figure 2.** Earthquakes magnitude 2.0 or larger between Oct. 1, 2004 and Sept. 30, 2005. Locations of a few cities are shown as white-filled diamonds. Earthquakes are indicated by red circles or green squares; red circles represent earthquakes at depths shallower than 30 km, and green squares represent earthquakes at 30 km or deeper.

Publications

Quarterly bulletins from the PNSN (<http://www.pnsn.org/REPTS/quarterly.html>) provide operational details and descriptions of seismic activity in Washington and Oregon. These are available from 1984 through the third quarter of 2004. Final published catalogs are available from 1970, when the network began operation, though 1989.

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